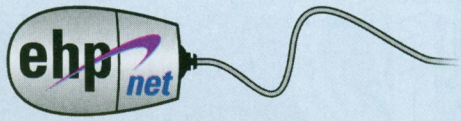
Monitoring and recovering contaminated leachate at closed landfills costs Waste Management hundreds of millions of dollars every year, Felker adds. The EPA requires monitoring for 30 years after a landfill is closed; if decay were more rapid, the hazard would abate faster, he points out. Rapid decomposition could also benefit neighbors of landfills. Presently, Ham says, the parties responsible for a landfill may be out of business before leakages of leachate or methane occur, preventing the recovery of damages.

But will bioreactors be safe? Ham thinks they can be. For one thing, they would retain the key features of modern landfills, including the methane recovery equipment and the clay and plastic bottom liners that prevent leachate from escaping. The major alteration would be to modify the cap that now prevents rainwater from entering, and to recirculate leachate or even add water to keep the garbage wet enough to decay.

The idea of bioreactors is catching on fast. Debra Reinhart, associate dean of the school of engineering at the University of Central Florida in Orlando, who has consulted on the issue for the EPA, says about 100 landfills nationwide are using some form of accelerated decomposition, with no reports of leakage. While short-term concerns such as possible clogging of recirculation systems remain to be investigated, she says, "[In the long term] this is certainly protective of groundwater, because you are treating the source of the contamination over a shorter period. When the barriers fail, the leachate will be less toxic. . . . This will become the state of the art in the near future."

The landfill industry is intrigued by the idea of shifting to bioreactors. "There's no reason it should not be done, or can't be done," says Ed Repa, director of environmental programs at the Environmental Industries Association. Another industry group, the Solid Waste Association of North America, expects to publish a white paper on bioreactors in June.

To help determine safety and optimize the technology, Ham is now consulting with a major waste hauler about building a state-of-the-art landfill to test a variety of advanced decomposition techniques. If the landfill fails, he says, liners and a leachate collection system would already be in place to prevent groundwater contamination. And if it works, it could save future generations the expense of monitoring thousands of landfills for at least 30 years after closure.




## Oceans of Knowledge

In 1966, Congress signed the National Sea Grant College and Program Act, which authorized "the establishment and operation of sea grant colleges and programs by initiating and supporting programs of education and research in the various fields relating to the development of marine resources." Today's National Sea Grant College Program, a consortium of 29 U.S. universities in partnership with the National Oceanic and Atmospheric Administration (NOAA), addresses such issues as aquatic resource management, environmental quality, and economic competitiveness. NOAA adminstrator James Baker calls it "one of the best examples in the country of a successful partnership between the federal government and the nation's best universities." The program's Web site, located at http://www.mdsg.umd.edu/NSGO/index.html, is not only a treasure trove of data from the past three decades' work but also a springboard for the work that still needs to be done.



The What Is Sea Grant? link describes the goals and mission of the National Sea Grant Program and the means, such as science education and technology transfer, by which the program meets those goals and achieves that mission. From this page, users may browse the Sea Grant's 1995–2005 Network Plan, which outlines how the program plans to address the issues of economic leadership, coastal ecosystem health and public safety, and education and human resources over the next few years. The Sea Grant Results–*Making A Difference* link leads to a newsy e-zine that describes ongoing research by various Sea Grant branches.

The 29 Sea Grant Colleges link enables users to access the Web sites of each of the member programs. This page also contains links to related projects and programs within the National Sea Grant Program. For instance, the Louisiana Sea Grant Legal Program, located at the Louisiana State University Law Center in Baton Rouge, maintains a page of resources for those interested in the judicial aspects of protecting U.S. waters.

The National Sea Grant Depository link leads to an archive, located at the University of Rhode Island in Narrangansett, of all the documents generated by Sea Grant-funded projects. By following the National Sea Grant Depository link, users may search a database of depository holdings, browse recent additions to the collection, submit a request to borrow archive materials, or order a subscription to the quarterly *Sea Grant Abstracts*, which summarizes most of the literature received by the National Sea Grant Depository.

The Sea Grant Sponsored Research link lists current research and outreach projects, such as the Oyster Disease Research Program and the Nonindigenous Species Research and Outreach Program. This link also includes searchable bibliographies of literature generated by Sea Grant-sponsored research projects.

The News link takes users to the Sea Grant Media Center, which is packed with National Sea Grant news releases, tip sheets, and radio interview transcripts, as well as links to online publications and related Web sites, and a calendar of marine science-related events. This link also lets users order Sea Grant Program publications and subscribe to the Sea Grant News e-mail news service. The What Is New? link on the home page allows readers to browse the most recent news releases.

The Funding & Fellowships link lists open requests for proposals, as well as employment vacancies within the National Sea Grant Program and overviews of the National Sea Grant Federal Fellows and Industrial Fellows programs. The Directories link offers searchable databases of program staff across the nation, and the Selected Publications link allows quick, direct access to the most commonly requested publications.